

フトの位相をずらし開閉時間を変更したり、リフト床を変更可能な可変式動力機構が開発されているが、その開閉時間の変更は構造上制限があった。

【0010】しかし、電磁式アクチュエータを用いて吸・排気弁を電気的に駆動することによりその開閉時間を任意に設定することが可能となった。そこで、本発明では、車両用エンジンの動作状態に適合させて任意に吸・排気弁の開閉タイミングを設定できる電磁式アクチュエータを用いて触媒活性化の制御を行うこととしたものである。

【0011】本発明の請求項1に係る車両用エンジンの触媒活性化装置は、エンジンが暖機中であるかを判定する暖機運転判定手段と吸・排気弁の開閉時間を任意に変更可能な吸・排気弁開閉時間調整手段とを具備している。そして、エンジンが暖機中であると判定した場合、排気弁の開閉開始時間を通常よりも早める。

【0012】したがって、エンジンは暖機完了後の通常運転時よりも、より高温の燃焼ガスを多く排出して触媒の昇温を早め、触媒が活性化温度に達するまでの時間を短縮することができる。これにより、触媒の早期活性化が図れ、触媒活性油の未浄化の排気ガスの排出を低減することが可能となる。

【0013】請求項2に係る車両用エンジンの触媒活性化装置は、請求項1に記載の手段に加えて更にエンジン荷を排出するエンジン負荷検出手段とエンジン負荷を排出するエンジン負荷を目標エンジン負荷に調整する調整してエンジン負荷を目標エンジン負荷に調整する調整手段とを有する。したがって、暖機中における触媒活性化時に吸気弁の開閉時間を調整し、請求項1に記載の吸・排気弁時間調整手段により排気弁の開閉開始時間を早めることによって変化するエンジン負荷を目標エンジン負荷に調整することができる。

【0014】請求項3に係る車両用エンジンの触媒活性化装置は、請求項2に記載の吸気弁の開閉時間の調整において、エンジン負荷が目標負荷よりも小さい場合、吸気弁の開閉完了時間を遅延させる。したがって、吸気空気量の増大によりエンジン負荷を増大させることができ、エンジン負荷を目標負荷に調整することが可能となる。

【0015】請求項4に係る車両用エンジンの触媒活性化装置は、請求項2に記載の吸気弁の開閉時間の調整において、吸気弁の開閉完了時間を調整してエンジンの実圧縮比を低下させる。したがって、理論燃熱効率は低下することとなり、エンジンの同一負荷に対する燃焼ガスの排出量はより増加すると共に、燃焼ガスの温度はより高くなる。これにより、排出される燃焼ガスの熱量を現在のエンジン負荷における最大熱量にすることができ、触媒の早期活性化を図ることが可能となる。

【0016】請求項5に係る車両用エンジンの触媒活性化装置は、請求項4に記載の吸気弁の開閉時間の調整において、エンジン負荷が目標負荷よりも小さい場合は吸

気弁の開閉開始時間を早める。したがって、吸気空気量の増大によりエンジン負荷は増大し、請求項4の作用に加えて更にエンジン負荷を目標負荷に調整することができ。

【0017】

【発明の実施の形態】以下、図面に基づいて本発明の実施の形態について詳細に説明する。図1は、本発明に係る車両用エンジンの触媒活性化装置が用いられる自動車用エンジン、例えば4サイクルエンジンの概略全体構成図である。

【0018】水平対向型のエンジン10本体は、複数の気筒11を有するシリンダ部12とシリンダヘッド部14とにより構成されており、吸気通路16及び排気通路18を具備している。

【0019】吸気通路16の上流側には、吸気チャナバ20がエンジンルーム内（図示せず）に開口し、吸気通路16の下流側はインテークマニホールド17から分岐して各気筒11に連通しており、吸気通路16の下流端は、吸気ポート30を介して各燃焼室32に連通している。そして、吸気通路16には、その上流側から順に、空気の塵埃を除去するエアクリナ22、吸気空気量Qを検出するエアフロメータ24、アケルバゲル（図示せず）の読み込み量に応じて吸気空気量Qを制御するスロットバルブ26が設けられている。

【0020】一方、排気通路18の下流側は本体後部（図示せず）に取付けられたマフラに接続され、排気通路14の上流側はエキゾーストパイプ38に接続され、各排気ポート40を介して各燃焼室32に連通している。また、エキゾーストパイプ38の下流側に三元触媒等の触媒39が介装され、触媒39には触媒の温度を検出する触媒温度センサ53が設けられている。

【0021】そして、吸気ポート30には吸気弁34が所定のタイミングで開閉可能に設けられ、排気ポート40には排気弁42が所定のタイミングで開閉可能に設けられている。吸気弁34及び排気弁42は、燃焼室32に対して突出する方向に移動することにより開弁し、戻す方向に移動することにより閉弁し、燃焼室32と吸気ポート30又は排気ポート40との間を連通又は遮断する。

【0022】シリンダヘッド部14には、吸気弁34及び排気弁42毎に各々電磁式のアクチュエータ44が設けられている。電磁式のアクチュエータ44は、電気的にON・OFF動作を行うソレノイド方式のものであり、動力駆動部45からの通電により吸気弁34及び排気弁42を開閉駆動するものである。

【0023】シリンダ部12には、ピストン46の位置（クランク角位置）及びエンジン回転数Nを検出するクランク角センサ50、及びエンジン10の冷却水温を検出する水温センサ52が設けられている。そして、スロットバルブ26には、スロットル開度θを検出する

スロットル開度センサ54が設けられている。そして、これら各センサからの検出信号を入力し、各制御手段に制御信号を出力して、エンジン動作を制御する電子制御装置（以下、単に「ECU」という）56が設けられている。

【0024】図2は、図1に示したECU56の内部構成を示す構成説明図である。図示のように、ECU56は、各センサからの検出信号を入力する入力インターフェイス56a、各制御手段への制御信号を出力する出力インターフェイス56b、主演算装置としてのCPU56c、制御プログラムや予め設定された固定データが記憶されているROM56d、各センサからの信号を処理した後のデータやCPU56cで演算処理したデータが格納されるRAM56e、さらに学習データなどを格納するバックアップRAM56f、タイマ56g等をバスシステムとして構成されている。

【0025】図3は、図1に示した排気弁42と、それを駆動するアクチュエータ44の内部構造を機能的に示した概略構造説明図である。なお、吸気弁34も同様の構造であることからその詳細な説明を省略する。図示のように、シリンダヘッド部14に上下方向に移動可能に設けられた排気弁42は、弁部42a及びバルブステム部42bより構成されている。

【0026】弁部42aは、排気弁42が上方に引き上げられた際にシリンダヘッド部14に開口する排気ポート40の開口部周縁40aに設けられたバルブシート部60と密着可能な形状に形成されている。そして、バルブステム部42bの頂部には磁性材料からなる可動子64が連結されている。この可動子64は、シリンダヘッド部14の上部に設けられたアクチュエータ44のケーシング62内に納められている。

【0027】ケーシング62内には、可動子64を上下方向より挟み、かつその間で可動子64が上下方向に移動可能な位置に開弁用コイル66と閉弁用コイル68が設けられている。そして、開弁用コイル66の内方からバルブステム部42bの外周には常に排気弁42を閉弁方向（図中、上方）に付勢する閉弁用スプリング70が設けられている。また、可動子64を挟んで反対側の閉弁用コイル68の内方には逆に排気弁42を開弁方向（図中、下方）に付勢する開弁用スプリング72が設けられている。

【0028】図4は、本発明の実施の形態の制御系に係る機能ブロック図である。図示のように、ECU56は、その内部にエンジン暖機状態判定部76、吸・排気弁開閉タイミング設定部78、アクチュエータ制御部78、動力駆動部45からの通電により吸気弁34及び排気弁42を開閉駆動するものである。図示は、燃焼室32の通常時と暖機中に於ける吸気弁34及び排気弁42の開弁期間Lを、ECU56が示す。

判断する。

【0029】吸・排気弁開閉タイミング設定部78は、スロットル開度センサ54及びクランク角センサ50からの検出信号に応じて現在のエンジン動作状態に応じた吸・排気弁の開閉時間を設定し、エンジン暖機状態判定部76から暖機中であるとの判定信号を受けた際は目標開閉時間を更新する。

【0030】アクチュエータ制御部78は、吸・排気弁開閉タイミング設定部78からの出力信号に基づき、吸・排気弁毎に設けられている各アクチュエータ44の制御量を算出し、動力駆動部45に制御信号を出力する。動力駆動部45は、制御信号cに基づき各アクチュエータ44に対して通電制御を行う。

【0031】次に、本発明の基本的な構成部品である電磁式吸・排気弁のアクチュエータ44の動作について図5を用いて説明する。図5は、アクチュエータ44に対して通電が行われた際の排気弁42の状態を概略的に示した要部説明図であり、同図（A）は排気弁42の開弁状態を示す説明図、同図（B）は閉弁状態を示す説明図である。なお、吸気弁34については排気弁42と同様の構成であるのでその詳細な説明は省略する。

【0032】同図（A）は、ECU56からの制御信号cに基づき動力駆動部45（図4参照）が開弁用コイル66に通電を行った場合を示している。図示のように、可動子64は開弁用コイル66の励磁力により開弁用スプリング70の付勢力に抗して開弁用コイル66に吸引される。したがって、排気弁42は燃焼室32内に突出し、弁部42aとバルブシート部60との間は開弁し、燃焼室32と排気ポート40の間は連通する。

【0033】また、同図（B）は閉弁用コイル68に通電を行った場合を示しており、図示のように、可動子64は閉弁用コイル68の励磁力により閉弁用スプリング72の付勢力に抗して閉弁用コイル68側に吸引され、排気弁42は上方に引き上げられる。したがって、弁部42aとバルブシート部60との間は閉弁し、燃焼室32と排気ポート40の間は遮断する。

【0034】以上のように、アクチュエータ44は、開弁用コイル66及び閉弁用コイル68に対して動力駆動部45により通電が行われると吸気弁34及び排気弁42を開閉制御する。

【0035】次に、上記構成の車両用エンジンの触媒活性化装置を用いた本発明の第1の実施の形態について、図6及び図7に基づいて説明する。図6は、上記構成の触媒活性化装置の動作を示すフローチャートである。図7は、吸気弁34及び排気弁42の開弁期間をエンジン10の行程順序に於て示した図であり、エンジン10の通常時と暖機中に於ける吸気弁34及び排気弁42の開弁期間を示したものである。なお、Lは吸気弁34の開弁期間Lを、Eは排気弁42の開弁期間Lを示す。

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【0036】図6に示したように、まず、ステップ(以下、単に「S」という)101において、現在のエンジン動作状態を検出する。ここでは、クラック角センサ50及びスロットル開度センサ54により検出したエンジン回転数Neとスロットル開度θからエンジン動作状態を検出する。そして、S102では吸・排気弁の開閉時期の検出と目標開閉時期を設定する。ここで、目標開閉時期は、S101にて検出したエンジン動作状態を用いてECU56のROM56d内に予め設けられているマップにより設定する。

【0037】次に、S103では、エンジン10の暖機状態を検出する。ここで、水温センサ52及び触媒温度センサ53により検出したエンジン冷却水温と触媒39の温度に基づいてエンジン暖機状態を検出する。S104では、S103にて検出したエンジン暖機状態によりエンジン10が現在、暖機中であるか否かの判断を行う。

【0038】ここで、S104においてエンジン10が暖機中ではない(「NO」と判断した場合、すなわち暖機を既に完了している場合(以下、単に「通常時」という))は、触媒39は既に活性状態であるので、S106へ移行し、S102にて設定した目標開閉時期により吸・排気弁の開閉制御を行う。

【0039】図7(A)は、通常時(図6のS104において「NO」という吸・排気弁の開閉時期を示している。図示のように、排気弁42はエンジン10が膨張行程1の後半にある時、すなわち燃焼室32内に混合気の燃焼後にピストン46が下死点(以下、単に「BDC」という)(180°)に到達するよりも手前(図中a点)で開弁し、エンジン10が排気行程Hを終了し吸気行程に入った時点、すなわちピストン46が上死点(以下、単に「TDC」という)(360°)に到達し若干過ぎたところで(図中c点)閉弁する。

【0040】また、吸気弁34は、エンジン10の排気行程Hの後半、すなわちピストン46が排気行程後のTDC(360°)に到達する少し手前(図中b点)で開弁し、エンジン10が吸気行程Kを終了し膨張行程Jに少し入った時点、すなわちピストン38が吸気行程後のBDC(540°)に到達し若干過ぎたところで(図中d点)閉弁する。吸・排気弁は、通常時において上記の開閉タイミングにより開閉制御される。

【0041】また、S104においてエンジン10が暖機中(YES)と判断した場合は、触媒39の温度は低く未だ活性状態にないため触媒39の早期活性化を行うべくS105へ移行する。S105では、S102にて設定した目標開閉時期の内、排気弁42の開閉開始時期を早める変更を行ない、S106において変更後の開閉時期により吸・排気弁の開閉制御を行う。

【0042】図7(B)は、暖機中(S104にてYES)における吸・排気弁の開閉時期を示している。図示

のように、排気弁42の開閉開始時期を早める(図中a点)変更が行われる。この開閉開始時期の変更により、エンジン10は通常時よりも燃焼ガスを多く排出することとなる。したがって、触媒39は急速に熱せられ、活性化するための時間を大幅に短縮することができ、

【0043】そして、以上の動作を行った後に本ルーチンを終了する(エンド)。

【0044】次に、本発明の第2の実施の形態について、図8及び図9を用いて以下に説明する。図8は第2の実施の形態における触媒活性化装置の動作を示すフローチャート、図9は図7と同様に吸・排気弁の開閉時期を示した図である。本実施の形態は、第1の実施の形態に加えて、更に吸気弁34の開閉時期の変更調整を行うものである。ここで、S201からS204までの動作は、第1の実施の形態におけるS101からS104までと同様であるのでその詳細な説明は省略する。

【0045】ここで、S204にてエンジン10が暖機中ではない(「NO」と判断した場合、すなわち通常時はS210へ移行し、S202にて設定した目標開閉時期により開閉制御を行う。また、S204にてエンジン10が暖機中である(YES)と判断した場合は、S205へ移行し、第1の実施の形態におけるS105と同様に排気弁42の開閉開始時期を早める変更を行い、S206へ移行する。S206では、吸気弁34の開弁完了時期を遅延させる(図9(B)中、d点からd1点へ)変更を行う。

【0046】したがって、燃焼室32内の圧縮比は低下し、それに伴い理論熱効率も低下する。そして、理論熱効率の低下に伴い、エンジンの同一負荷に対する燃焼ガスの排出量はより増加すると共に、燃焼ガスの温度はより高温化する。これにより、排出される燃焼ガスの熱量を現在のエンジン負荷における最大熱量にすることができ、触媒が活性温度に達するまでの時間を大幅に短縮することができる。

【0047】次に、S207以降では吸気弁34の開閉開始時期の調整が行われる(図(B)中、c点)。S207において、クラック角センサ50より検出したエンジン回転数Neとエアフロメータ24により検出した吸入空気量Qとにより実際のエンジン負荷を検出し、S208にてスロットル開度センサ54の検出信号より目標負荷を算出する。

【0048】そして、S209では、S207とS208にて検出したエンジン負荷と目標負荷を比較し、その差を算出する。そして、その差に応じて、エンジン負荷が目標負荷よりも小さい場合は吸気弁34の開閉開始時期を早め、エンジン負荷が目標負荷以上の場合は吸気弁34の開閉開始時期を遅らせるように吸気弁34の開閉開始時期を変更し、S210に移行する。

【0049】S210ではS205からS209において

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て変更した開閉時期により吸・排気弁の開閉制御を行う。したがって、エンジン負荷は目標負荷に調整される。以上の制御を行った後に、本ルーチンを終了する(エンド)。

【0050】したがって、暖機中における圧縮比の低下に伴うエンジン負荷の低下を防止することができる。また、吸気弁34の開閉開始時期(c点)を調整することによりエンジン負荷に対して、燃焼ガスの熱量を常に最大に調整することができる。

【0051】
【発明の効果】以上説明したように、本発明に係る車両用エンジンの触媒活性化装置によれば、従来のような複数の装置及び制御を用いることなく、暖機中の触媒の昇温時間を大幅に短縮することができ、触媒の早期活性化を容易に行うことができ、暖機中における未浄化の排気ガスの排出量を低減することが可能となる。

【図面の簡単な説明】
【図1】本発明に係る車両用エンジンの触媒活性化装置が用いられる自動車エンジンの概略全体構成図である。

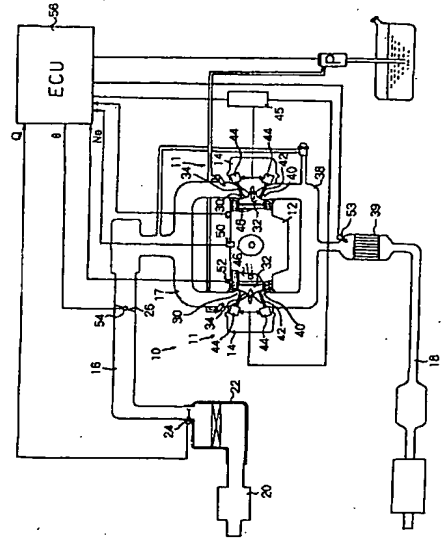
【図2】図1に示したECU56の内部構成を示す構成説明図である。

【図3】図1に示した排気弁42を駆動するアクチュエータ44の内部構造を概略的に示した概略構造説明図である。

【図4】本発明の実施の形態の制御系に係る機能ブロック図である。

【図5】アクチュエータ44に対して通電が行われた際の排気弁42の状態を概略的に示した要部説明図である。

(図1)



10

【図6】本発明の第1の実施の形態における車両用エンジンの触媒活性化装置の動作を示すフローチャートである。

【図7】本発明の第1の実施の形態における吸気弁34及び排気弁42の開閉時期をエンジン10の行程順序に沿って示した図である。

【図8】本発明の第2の実施の形態における車両用エンジンの触媒活性化装置の動作を示すフローチャートである。

【図9】本発明の第2の実施の形態における吸気弁34及び排気弁42の開閉時期を示した図である。

【符号の説明】

10 エンジン

12 シリンダ部

14 シリンダヘッド部

16 吸気通路

18 排気通路

24 エアフロメータ

26 スロットルバルブ

34 吸気弁

39 触媒

42 排気弁

44 アクチュエータ

45 動力駆動部

53 触媒温度センサ

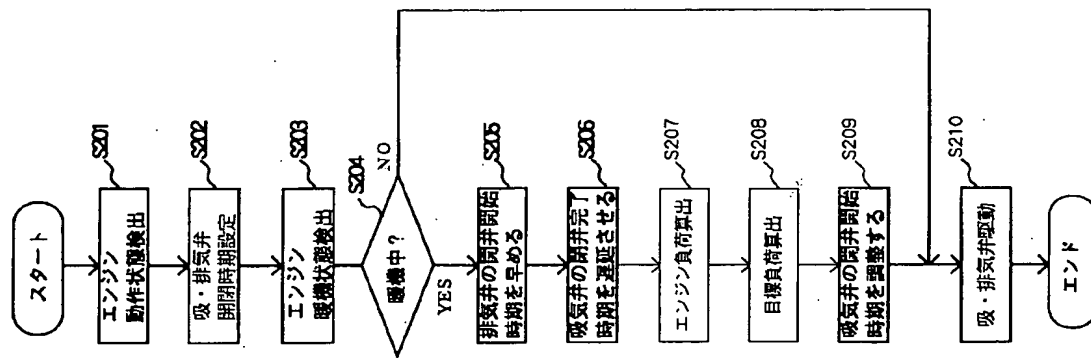
54 スロットル開度センサ

56 電子制御装置

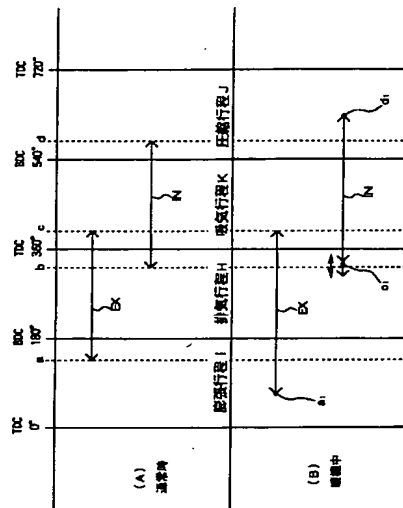
76 エンジン暖機状態判定部(暖機遅延判定手段)

78 吸・排気弁開閉タイミング設定部(吸・排気弁開閉時期調整手段)

【図8】



【図9】



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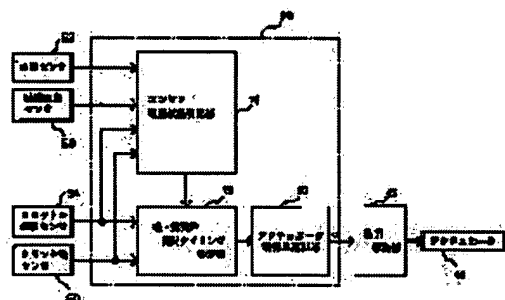
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(54) CATALYST ACTIVATING DEVICE FOR VEHICLE ENGINE

(57)Abstract:

PROBLEM TO BE SOLVED: To eliminate necessity for a supplying device of secondary air and the like, and activate a catalyst in an earlier stage by controlling an exhaust valve to advance a valve opening start timing of the valve when warming-up of an engine is judged, in a device in which intake and exhaust valves are opening/closing controlled by an electromagnetic actuator.

SOLUTION: During operation of an engine, an engine operating condition is detected by an engine warming-up condition judging unit 76 of an ECU 56, the target opening/closing timing of intake/exhaust valves according to an engine operating condition is set by an intake/exhaust valve opening/closing timing setting unit 78, and the target opening/closing timing is changed when the judging signal of the warming-up is received from an engine warming-up condition judging unit 76. Namely, in the case where warming-up of the engine is judged, the opening valve starting timing of the exhaust valve is advanced and changed. The controlled variable of each actuator 44 arranged per intake/ exhaust valve is calculated on the basis of the output signal from the intake/ exhaust valve opening/closing timing setting unit 78 by an actuator controlled variable calculating unit 80, and a control signal c is outputted to a valve system driving part 45.



LEGAL STATUS

[Date of request for examination]

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[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to the catalytic activity-ized equipment of the engine for vehicles which has ** and the exhaust air valve-control system which performs automatic opening-and-closing control of the catalytic activity-ized equipment of the engine for vehicles, especially ***** and an exhaust valve.

[0002]

[Description of the Prior Art] Conventionally, there is a catalyst system which used catalysts, such as a three way component catalyst or an oxidation catalyst, for the exhaust air system as one of the purification systems of the exhaust gas of an automobile. A three way component catalyst can reduce simultaneously three detrimental components (HC, CO, NOx) contained in exhaust gas by carrying out feedback control of the air-fuel ratio of a catalyst entrance near the theoretical air fuel ratio. Moreover, an oxidation catalyst reduces two detrimental components (HC, CO) by maintaining the air-fuel ratio of a catalyst entrance at an oxidizing atmosphere.

[0003] And the purification efficiency in which these catalysts purify an injurious ingredient when the temperature of a catalyst is more than predetermined temperature is good, and purification efficiency is bad when the degree of catalyst temperature is below predetermined temperature. Therefore, there was a problem that non-purified exhaust gas will be discharged until a catalyst reaches the predetermined temperature from which the degree of catalyst temperature will be in an active state at a low sake during warming up of an engine.

[0004]

[Problem(s) to be Solved by the Invention] In order to reduce HC in the exhaust gas which is not purified [which is discharged during such warming up], CO, etc., various proposals have been made from before. For example, the secondary air supply is known as one of them. A secondary air supply supplies oxygen required to oxidize and purify HC and CO during warming up to the exhaust manifold of the upstream of a catalyst as the secondary air.

[0005] However, the secondary air supply always had to control the secondary air amount of supply to make purification efficiency of a catalyst into the maximum, and when it is complicated and the secondary air was increased too much, the exhaust gas temperature of a catalyst entrance fell, and the control had the problem of worsening purification efficiency on the contrary.

[0006] Moreover, the system using the electric heating catalyst (only henceforth "EHC") as other equipments is proposed. At the time between the engine colds, EHC makes a catalyst heat compulsorily by the electric heater, when [when the temperature of a catalyst is low] activity is inadequate, and it improves purification efficiency. However, in order to use EHC as an object for vehicles, a high current is needed and there are problems, such as aggravation of endurance, such as a heatproof and vibration resistance, power consumption, and the mpg by weight increase. Moreover, each above-mentioned equipment newly had to form the equipment of exclusive use, and had invited the jump of cost for complication of the increase in part mark, and its control.

[0007] this invention is made in view of the above-mentioned technical problem, and the purpose needs neither the feeder of the secondary air like before, nor the heater equipment for heating, but attains early activation of a catalyst, and is to offer the catalytic activity-ized equipment of the engine for vehicles which can reduce the amount of exhaust outlets which is not purified under warming up.

[0008]

[Means for Solving the Problem] the valve gear which this invention becomes from the cam shaft from the former etc. -- replacing with -- opening-and-closing control of ** and an exhaust valve -- electromagnetism -- it is premised on the system performed with the actuator using the means That is, it notes being able to set up freely the opening-and-closing stage of ** and the exhaust valve opened and closed using this electromagnetic actuator.

[0009] In the valve gear using the conventional cam shaft etc., the switching action of ** and an exhaust valve was being interlocked with the crankshaft of an engine, and to the position of the piston of an engine, the opening-and-closing stage is always fixed, and was not able to be set up freely. Moreover, although the phase of a cam shaft was shifted, the opening-and-closing stage was changed or the adjustable formula valve gear which can change the amount of lifts was developed by the service condition in recent years, change of the opening-and-closing stage had a limit on structure.

[0010] However, it became possible by driving ** and an exhaust valve electrically using an electromagnetic actuator to set up the opening-and-closing stage arbitrarily. Then, suppose that catalytic activity-ization is controlled by this invention using the electromagnetic actuator which is fitted to the operating state of the engine for vehicles, and can set up the opening-and-closing timing of ** and an exhaust valve arbitrarily.

[0011] The catalytic activity-ized equipment of the engine for vehicles concerning the claim 1 of this invention possesses arbitrarily ** and the exhaust air valve timing adjustment means which can be changed for the opening-and-closing stage of a warm-up judging means, and a ** and an exhaust valve to judge whether an engine is during warming up. And when it judges with an engine being during warming up, the valve-opening start stage of an exhaust valve is brought forward rather than usual.

[0012] Therefore, rather than the time of usual operation after warming-up completion, an engine can discharge many hotter combustion gas, can bring the temperature up of a catalyst forward, and can shorten time until a catalyst reaches activity temperature. Thereby, early activation of a catalyst can be attained and it becomes possible to reduce the exhaust outlet which is not purified before catalytic activity.

[0013] The catalytic activity-ized equipment of the engine for vehicles concerning a claim 2 has a target load setting means to resemble a means according to claim 1, in addition to set up the target load of an engine further, and an engine load detection means to detect an engine load. And the opening-and-closing stage of an inlet valve is adjusted at the time of catalytic-activity[under warming up]-izing, and an engine load is adjusted to a target engine load. Therefore, the engine load which changes by bringing forward the valve-opening start stage of an exhaust valve by ** and an exhaust air valve-timing adjustment means according to claim 1 can be adjusted to a target load.

[0014] In adjustment of the opening-and-closing stage of an inlet valve according to claim 2, the catalytic activity-ized equipment of the engine for vehicles concerning a claim 3 delays the completion stage of valve closing of an inlet valve, when an engine load is smaller than a target load. Therefore, an engine load can be increased by increase of an inhalation air content, and it becomes possible to adjust an engine load to a target load.

[0015] In adjustment of the opening-and-closing stage of an inlet valve according to claim 2, the catalytic activity-ized equipment of the engine for vehicles concerning a claim 4 adjusts the completion stage of valve closing of an inlet valve, and reduces the real compression ratio of an engine. Therefore, while a theoretical thermal efficiency will fall and the discharge of combustion gas to the same load of an engine increases more, temperature of combustion gas is elevated-temperature-ized more. The heating value of the combustion gas discharged can be made into the maximum heating value in the present engine load by this, and it becomes possible to attain early activation of a catalyst.

[0016] In adjustment of the opening-and-closing stage of an inlet valve according to claim 4, the

catalytic activity-ized equipment of the engine for vehicles concerning a claim 5 brings forward the valve-opening start stage of an inlet valve, when an engine load is smaller than a target load. Therefore, an engine load increases by increase of an inhalation air content, and, in addition to an operation of a claim 4, an engine load can be further adjusted to a target load.

[0017]

[Embodiments of the Invention] Hereafter, based on a drawing, the gestalt of operation of this invention is explained in detail. Drawing 1 is the whole outline block diagram of the engine of the automobile by which the catalytic activity-ized equipment of the engine for vehicles concerning this invention is used, for example, a four stroke cycle engine.

[0018] Engine 10 main part of a level opposed type is constituted by the cylinder part 12 and the cylinder head section 14 which have two or more cylinders 11, and possesses the inhalation-of-air path 16 and the flueway 18.

[0019] In the upstream of the inhalation-of-air path 16, opening is carried out into an engine room (not shown), the downstream of the inhalation-of-air path 16 branches from an intake manifold 17, and is open for free passage in each cylinder 11, and the inhalation-of-air chamber 20 is opening the downstream edge of the inhalation-of-air path 16 for free passage through a suction port 30 in each combustion chamber 32. And the air cleaner 22 which removes the dust in air, the air flow meter 24 which detects the inhalation air content Q, and the throttle valve 26 which controls the inhalation air content Q according to the amount of treading in of an accelerator pedal (not shown) are formed in the inhalation-of-air path 16 sequentially from the upstream.

[0020] On the other hand, the downstream of a flueway 18 is connected to the muffler attached in the body posterior part (not shown), it connects with an exhaust pipe 38 and the upstream of a flueway 14 is opened for free passage by each combustion chamber 32 through each exhaust air port 40. Moreover, the catalysts 39, such as a three way component catalyst, are infixed in the downstream of an exhaust pipe 38, and the degree sensor 53 of catalyst temperature which detects the temperature of a catalyst is formed in the catalyst 39.

[0021] And an inlet valve 34 is formed in a suction port 30 possible [opening and closing] to predetermined timing, and the exhaust valve 42 is formed in the exhaust air port 40 possible [opening and closing] to predetermined timing. By moving in the direction which projects to a combustion chamber 32, an inlet valve 34 and an exhaust valve 42 are closed by opening and moving in the to return, and open for free passage or intercept between a combustion chamber 32, a suction port 30, or the exhaust air ports 40.

[0022] The electromagnetic actuator 44 is respectively formed in the cylinder head section 14 every inlet valve 34 and exhaust valve 42. The electromagnetic actuator 44 is a thing of a solenoid method which performs ON-OFF operation electrically, and carries out the opening-and-closing drive of an inlet valve 34 and the exhaust valve 42 by energization from the valve train mechanical component 45.

[0023] The crank angle sensor 50 which detects the position (the degree position of crank angle) and engine speed Ne of a piston 46, and the coolant temperature sensor 52 which detects the cooling water temperature of an engine 10 are formed in the cylinder part 12. And the throttle opening sensor 54 which detects the throttle opening theta is formed in the throttle valve 26. And the detecting signal from each [these] sensor is inputted, a control signal is outputted to each control means, and the electronic control (only henceforth "ECU") 56 which controls engine operation is formed.

[0024] Drawing 2 is composition explanatory drawing showing the internal configuration of ECU56 shown in drawing 1. Input interface 56a into which ECU56 inputs the detecting signal from each sensor like illustration, Output interface 56b which outputs the control signal to each control means, CPU56c as a main arithmetic unit, ROM56d a control program and the fixed data set up beforehand are remembered to be, RAM56e in which data after processing the signal from each sensors, and the data which carried out data processing by CPU56c are stored, It is constituted as a microcomputer system which comes to connect mutually backup RAM56f which furthermore stores study data etc., timer 56g, etc. by bus-line 56h.

[0025] Drawing 3 is outline structure explanatory drawing having shown functionally the internal

structure of the exhaust valve 42 shown in drawing 1 , and the actuator 44 which drives it. In addition, since an inlet valve 34 is also the same structure, the detailed explanation is omitted. Like illustration, the exhaust valve 42 prepared in the cylinder head section 14 possible [movement in the vertical direction] consists of valve portion 42a and valve-stem section 42b.

[0026] When an exhaust valve 42 is able to pull up valve portion 42a up, it is formed in the configuration which was prepared in opening periphery 40a of the exhaust air port 40 which carries out opening to the cylinder head section 14 and in which the valve-seat section 60 and adhesion are And the needle 64 which consists of a magnetic material is connected with the parietal region of valve-stem section 42b. This needle 64 is dedicated in the casing 62 of the actuator 44 formed in the upper part of the cylinder head section 14.

[0027] In casing 62, a needle 64 is pinched from the vertical direction, and the coil 66 for valve opening and the coil 68 for valve closing are formed in the position which a needle 64 can move in the vertical direction by the meantime. And it is the inner direction of the coil 66 for valve opening, and the spring 70 for valve closing which always energizes an exhaust valve 42 in the valve-closing direction (the inside of drawing, above) is formed in the periphery of valve-stem section 42b. Moreover, on both sides of the needle 64, the spring 72 for valve opening which energizes an exhaust valve 42 in the valve-opening direction (the inside of drawing, down) conversely is formed in the inner direction of the coil 68 for valve closing of an opposite side.

[0028] Drawing 4 is a functional block diagram concerning the control system of the gestalt of operation of this invention. Like illustration, ECU56 possesses the engine standby judging section 76, ** and the exhaust-valve-opens close timing setting section 78, and the actuator controlled-variable calculation section 80 in the interior. The engine standby judging section 76 inputs the detecting signal from the crank angle sensor 50, a coolant temperature sensor 52, the degree sensor 53 of catalyst temperature, and the throttle opening sensor 54, and the present engine operating state judges whether it is under [warming-up] *****.

[0029] ** and the exhaust-valve-opens close timing setting section 78 set up the target opening-and-closing stage of the ** and the exhaust valve according to the present engine operating state according to the detecting signal from the throttle opening sensor 54 and the crank angle sensor 50, and when it receives the judgment signal that it is during warming up from the engine standby judging section 76, it changes a target opening-and-closing stage.

[0030] The actuator controlled-variable calculation section 80 computes the controlled variable of each actuator 44 formed for every ** and exhaust valve based on the output signal from ** and the exhaust-valve-opens close timing setting section 78, and outputs a control signal c to the valve train mechanical component 45. The valve train mechanical component 45 performs energization control to each actuator 44 based on a control signal c.

[0031] Next, operation of the actuator 44 of the ***** and the exhaust valve which is the fundamental component part of this invention is explained using drawing 5 . Drawing 5 is important section explanatory drawing having shown roughly the state of the exhaust valve 42 at the time of energization being performed to an actuator 44, and explanatory drawing showing [this] the valve-opening state of an exhaust valve 42 (A) and this drawing (B) are explanatory drawings showing a valve-closing state. In addition, since it is the composition same about an inlet valve 34 as an exhaust valve 42, the detailed explanation is omitted.

[0032] This drawing (A) shows the case where the valve train mechanical component 45 (refer to drawing 4) energizes in the coil 66 for valve opening based on the control signal c from ECU56. Like illustration, a needle 64 resists the energization force of the spring 70 for valve closing according to the excitation force of the coil 66 for valve opening, and is attracted by the coil 66 for valve opening. Therefore, it projects in a combustion chamber 32, and opens between valve portion 42a and the valve-seat section 60, and an exhaust valve 42 is opened for free passage between a combustion chamber 32 and the exhaust air port 40.

[0033] Moreover, this drawing (B) shows the case where it energizes in the coil 68 for valve closing, and like illustration, a needle 64 resists the energization force of the spring 72 for valve opening

according to the excitation force of the coil 68 for valve closing, is attracted at the coil 68 side for valve closing, and can pull up an exhaust valve 42 up. Therefore, the valve is closed between valve portion 42a and the valve-seat section 60, and it intercepts between a combustion chamber 32 and the exhaust air port 40.

[0034] As mentioned above, an actuator 44 will carry out opening-and-closing control of an inlet valve 34 and the exhaust valve 42, if energization is performed by the valve train mechanical component 45 to the coil 66 for valve opening, and the coil 68 for valve closing.

[0035] Next, the gestalt of operation of the 1st of this invention using the catalytic activity-ized equipment of the engine for vehicles of the above-mentioned composition is explained based on drawing 6 and drawing 7. Drawing 6 is a flow chart which shows operation of the catalytic activity-ized equipment of the above-mentioned composition. Drawing 7 is drawing having shown the valve-opening period of an inlet valve 34 and an exhaust valve 42 in accordance with the distance sequence of an engine 10, and shows the valve-opening period of the inlet valve 34 under the time and warming up usually and exhaust valve 42 of an engine 10. In addition, IN shows the valve-opening period Li of an inlet valve 34, and EX shows the valve-opening period Le of an exhaust valve 42.

[0036] As shown in drawing 6, in Step (only henceforth "S") 101, the present engine operating state is detected first. Here, engine operating state is detected from the engine speed Ne detected by the crank angle sensor 50 and the throttle opening sensor 54, and the throttle opening theta. And in S102, the target opening-and-closing stage to become the criteria of the opening-and-closing stage of ** and an exhaust valve is set up. Here, a target opening-and-closing stage is set up on the map beforehand prepared in ROM56d of ECU56 using the engine operating state detected in S101.

[0037] Next, the standby of an engine 10 is detected in S103. Here, engine standby is detected based on the temperature of engine-cooling-water ** detected by the coolant temperature sensor 52 and the degree sensor 53 of catalyst temperature, and a catalyst 39. In S104, an engine 10 judges whether it is during warming up according to the engine standby detected in S103 now.

[0038] Here, since a catalyst 39 is already an active state when it is judged as (NO) whose engine 10 is not during warming up in S104 (it only says hereafter, "it is usually at the time") (i.e., when having already completed warming up), it shifts to S106 and the target opening-and-closing stage set up in S102 performs opening-and-closing control of ** and an exhaust valve.

[0039] Drawing 7 (A) usually shows the valve-opening period of the ** and the exhaust valve at the time (it is NO at S104 of drawing 6). When an exhaust valve 42 has an engine 10 like illustration in the second half of an expansion stroke I, A piston 46 after explosion of a gaseous mixture in a combustion chamber 32 Namely, a bottom dead point It opens in this side (inside of drawing a points) rather than it reaches. (It is only hereafter called BDC) (180 degrees) The valve is closed in the place which the time 46 of an exhaust air line ending H and an engine 10 going into an intake stroke, i.e., a piston, arrived at the top dead center (only henceforth TDC) (360 degrees), and was passed a little (inside of drawing c points).

[0040] Moreover, an inlet valve 34 is closed like the exhaust air line of an engine 10 in the place which the exhaust air line reached BDC (540 degrees) after an intake stroke as for the time 38 of opening for a while in this side (inside of drawing b points), and an engine 10 ending an intake stroke K, and going into a compression stroke J for a while at which next TDC (360 degrees) is reached, i.e., a piston, and was passed a little in the second half 46 of H, i.e., a piston, (inside of drawing Opening-and-closing control of ** and the exhaust valve is usually sometimes carried out by the above-mentioned opening-and-closing timing.

[0041] Moreover, when an engine 10 judges it as under warming up (YES) in S104, since there is still no temperature of a catalyst 39 in an active state low, it shifts to S105 to perform early activation of a catalyst 39. In S105, a change which brings forward the valve-opening start stage of an exhaust valve 42 among the target opening-and-closing stages set up in S102 is made, and the opening-and-closing stage after change performs opening-and-closing control of ** and an exhaust valve in S106.

[0042] Drawing 7 (B) shows the valve-opening period of the ** and the exhaust valve under warming up (it is YES at S104). Like illustration, a change which brings forward the valve-opening start stage of

an exhaust valve 42 (inside a of drawing one point) is made. By change of this valve-opening start stage, an engine 10 will usually discharge many combustion gas rather than the time. Therefore, a catalyst 39 is heated quickly and can shorten time until it is activated sharply.

[0043] And this routine is ended after performing the above operation (end).

[0044] Next, the gestalt of operation of the 2nd of this invention is explained below using drawing 8 and drawing 9. The flow chart and drawing 9 which show operation of catalytic activity-ized equipment [in / the gestalt of the 2nd operation / in drawing 8] are drawing having shown the valve-opening period of ** and an exhaust valve like drawing 7. In addition to the gestalt of the 1st operation, the gestalt of this operation performs change adjustment of the opening-and-closing stage of an inlet valve 34 further. Since operation from S201 to S204 is the same as that of S101 in the gestalt of the 1st operation to S104 here, the detailed explanation is omitted.

[0045] Here, when it is judged as (NO) whose engine 10 is not during warming up in S204, usually, it shifts to S210 at the time, and the target opening-and-closing valve timing set up in S202 performs opening-and-closing control. Moreover, when it is judged in S204 that an engine 10 is during warming up (YES), it shifts to S205, and a change which brings forward the valve-opening start stage of an exhaust valve 42 like S105 in the gestalt of the 1st operation is made, and it shifts to S206. In S206, a change which delays the completion stage of valve closing of an inlet valve 34 to from the inside of drawing 9 (B) and d points to d1 point is made.

[0046] Therefore, the real compression ratio in a combustion chamber 32 falls, and a theoretical thermal efficiency also falls in connection with it. And while the discharge of combustion gas to the same load of an engine increases more with decline in a theoretical thermal efficiency, temperature of combustion gas is elevated-temperature-ized more. The heating value of the combustion gas discharged can be made into the maximum heating value in the present engine load by this, and time until a catalyst reaches activity temperature can be shortened sharply.

[0047] Next, henceforth [S207], adjustment of the valve-opening start stage of an inlet valve 34 is performed (the inside of drawing (B), c points). In S207, the inhalation air content Q detected with the engine speed Ne detected from the crank angle sensor 50 and the air flow meter 24 detects an actual engine load, and a target load is computed from the detecting signal of the throttle opening sensor 54 in S208.

[0048] And in S209, the engine load and target load which were detected in S207 and S208 are compared, and the difference is computed. And when an engine load is smaller than a target load, the valve-opening start stage of an inlet valve 34 is brought forward, according to the difference, when an engine load is more than a target load, the valve-opening start stage of an inlet valve 34 is changed so that the valve-opening start stage of an inlet valve 34 may be delayed, and it shifts to S210.

[0049] In S210, the opening-and-closing stage changed in S205 to S209 performs opening-and-closing control of ** and an exhaust valve. Therefore, an engine load is adjusted to a target load. This routine is ended after performing the above control (end).

[0050] Therefore, the fall of the engine load accompanying the fall of the real compression ratio under warming up can be prevented. Moreover, the heating value of combustion gas can always be adjusted to the maximum to an engine load by adjusting the valve-opening start stage (c points) of an inlet valve 34.

[0051]

[Effect of the Invention] Without using the complicated equipment and complicated control like before according to the catalytic activity-ized equipment of the engine for vehicles concerning this invention, as explained above, the heating up time of the catalyst under warming up can be shortened sharply, early activation of a catalyst can be performed easily, and it becomes possible to reduce the amount of exhaust outlets which is not purified under warming up.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the whole outline block diagram of the engine of the automobile by which the catalytic activity-ized equipment of the engine for vehicles concerning this invention is used.

[Drawing 2] It is composition explanatory drawing showing the internal configuration of ECU56 shown in drawing 1 .

[Drawing 3] It is outline structure explanatory drawing having shown roughly the internal structure of an actuator 44 which drives the exhaust valve 42 shown in drawing 1 .

[Drawing 4] It is a functional block diagram concerning the control system of the form of operation of this invention.

[Drawing 5] It is important section explanatory drawing having shown roughly the state of the exhaust valve 42 at the time of energization being performed to an actuator 44.

[Drawing 6] It is the flow chart which shows operation of the catalytic activity-ized equipment of the engine for vehicles in the form of operation of the 1st of this invention.

[Drawing 7] It is drawing having shown the opening-and-closing time of the inlet valve 34 in the form of operation of the 1st of this invention, and an exhaust valve 42 in accordance with the distance sequence of an engine 10.

[Drawing 8] It is the flow chart which shows operation of the catalytic activity-ized equipment of the engine for vehicles in the form of operation of the 2nd of this invention.

[Drawing 9] It is drawing having shown the opening-and-closing time of the inlet valve 34 in the form of operation of the 2nd of this invention, and an exhaust valve 42.

[Description of Notations]

10 Engine

12 Cylinder Part

14 Cylinder Head Section

16 Inhalation-of-Air Path

18 Flueway

24 Air Flow Meter

26 Throttle Valve

34 Inlet Valve

39 Catalyst

42 Exhaust Valve

44 Actuator

45 Valve Train Mechanical Component

53 The Degree Sensor of Catalyst Temperature

54 Throttle Opening Sensor

56 Electronic Control

76 Engine Standby Judging Section (Warm-up Judging Means)

78 ** and Exhaust-Valve-Opens Close Timing Setting Section (** and Exhaust Air Valve Timing

Adjustment Means)

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CLAIMS

[Claim(s)]

[Claim 1] In the catalytic activity-ized equipment of the engine for vehicles which has ** and the exhaust air valve-control system which performs automatic opening-and-closing control of ***** and an exhaust valve A warm-up judging means to judge whether the aforementioned engine is during warming up, ** and an exhaust air valve timing adjustment means to change one [at least] stage of the valve-opening start stage of the inlet valve of the aforementioned ***** and exhaust valve, or an exhaust valve, or the completion stage of valve closing, Catalytic activity-ized equipment of the engine for vehicles characterized by bringing forward the valve-opening start stage of the aforementioned exhaust valve when it **** and is judged with under warming up with the aforementioned warm-up judging means.

[Claim 2] Catalytic activity-ized equipment of the engine for vehicles according to claim 1 characterized by having a target load setting means to set up the target load of the aforementioned engine, and an engine load detection means to detect the load of the aforementioned engine, adjusting the opening-and-closing stage of the aforementioned inlet valve, and adjusting the aforementioned engine load to the aforementioned target load.

[Claim 3] Catalytic activity-ized equipment of the engine for vehicles according to claim 2 characterized by increasing the aforementioned engine load and making it the same as that of the aforementioned target load by delaying the completion stage of valve closing of the aforementioned inlet valve when the engine load which carried out [aforementioned] detection is smaller than the aforementioned target load.

[Claim 4] Catalytic activity-ized equipment of the engine for vehicles according to claim 2 or 3 characterized by adjusting the completion stage of valve closing of the aforementioned inlet valve, and reducing the real compression ratio of the aforementioned engine.

[Claim 5] It is catalytic activity-ized equipment of the engine for vehicles according to claim 4 characterized by bringing forward the valve-opening start stage of the aforementioned inlet valve, increasing the aforementioned engine load, and making it the same as that of the aforementioned target load when the engine load which carried out [aforementioned] detection is smaller than the aforementioned target load.

[Translation done.]

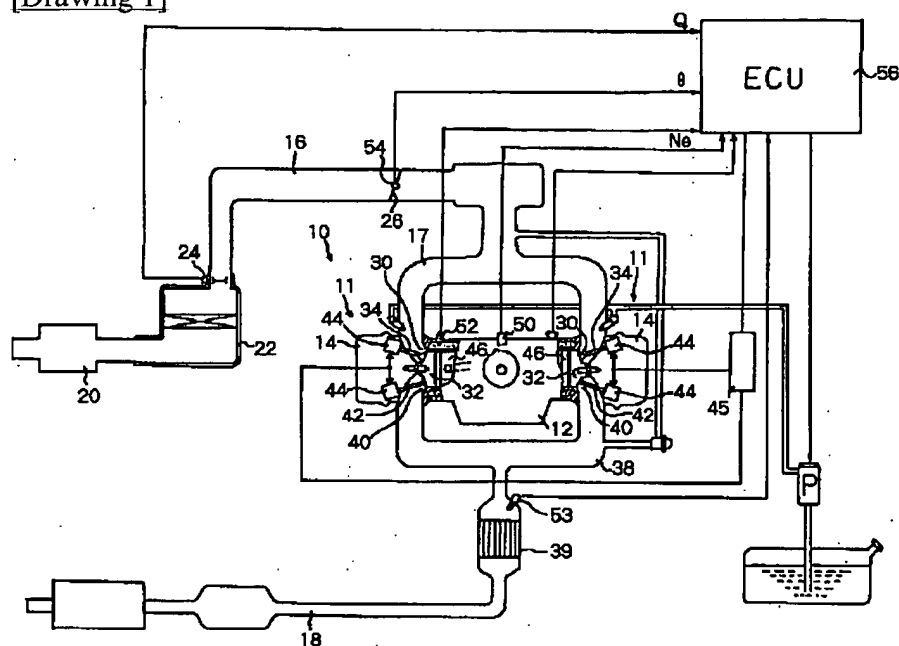
* NOTICES *

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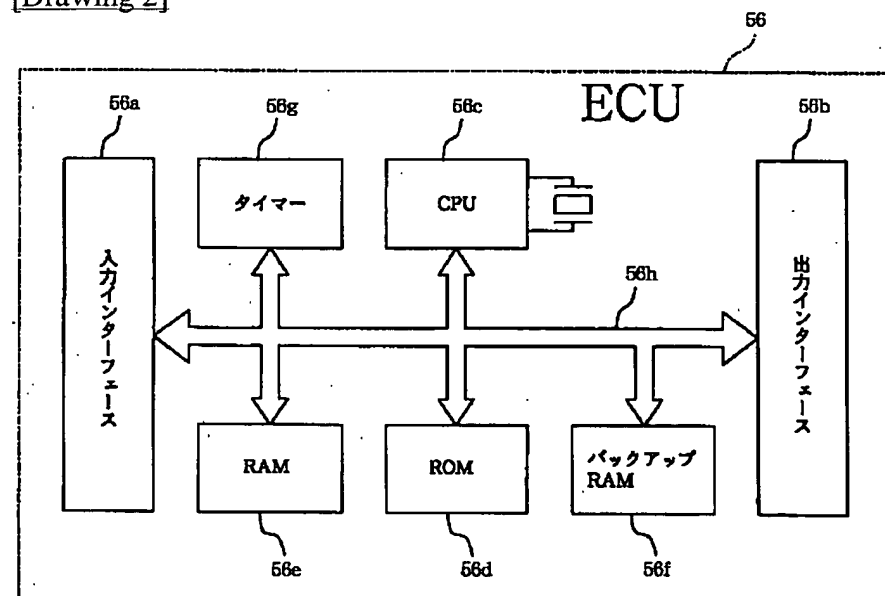
1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

DRAWINGS

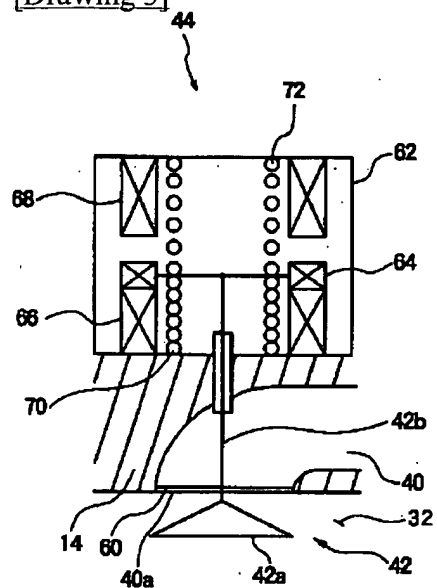
[Drawing 1]



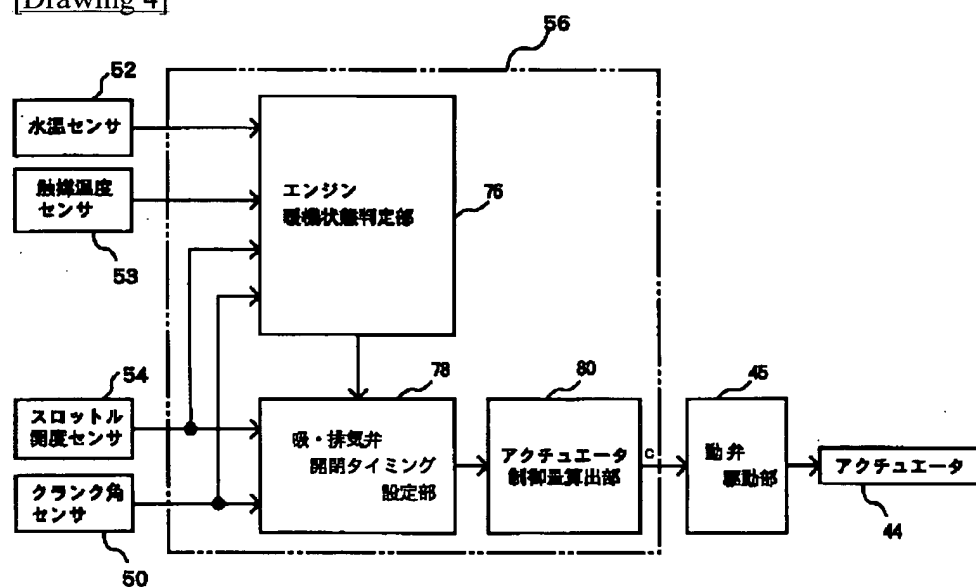
[Drawing 2]



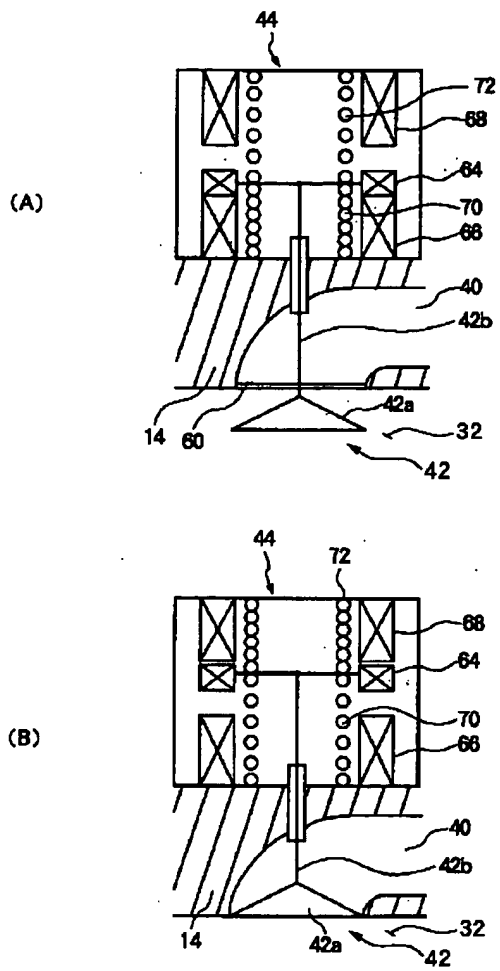
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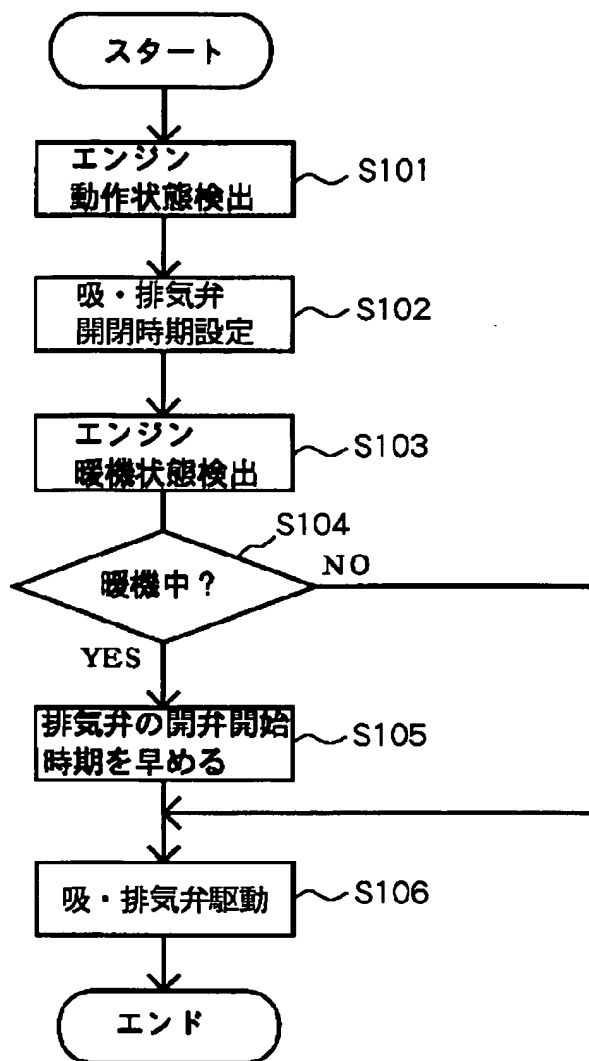
[Drawing 4]



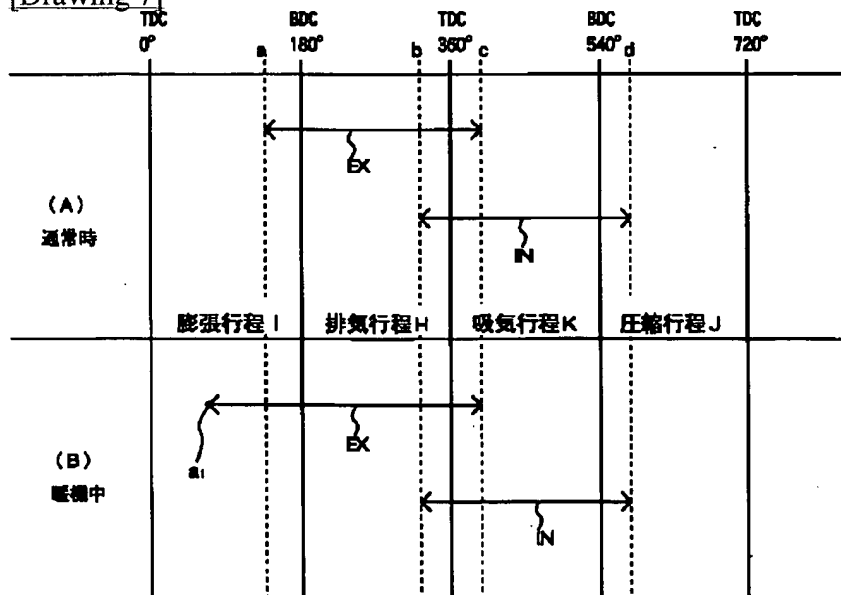
[Drawing 5]



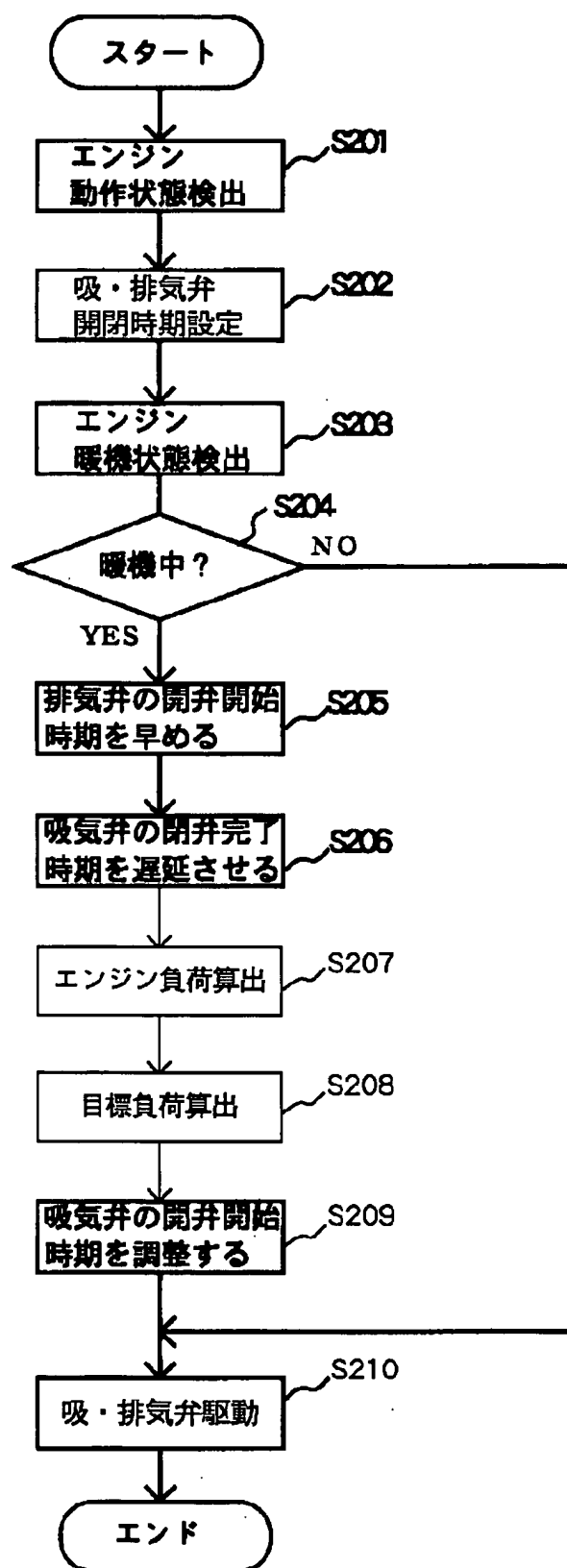
[Drawing 6]



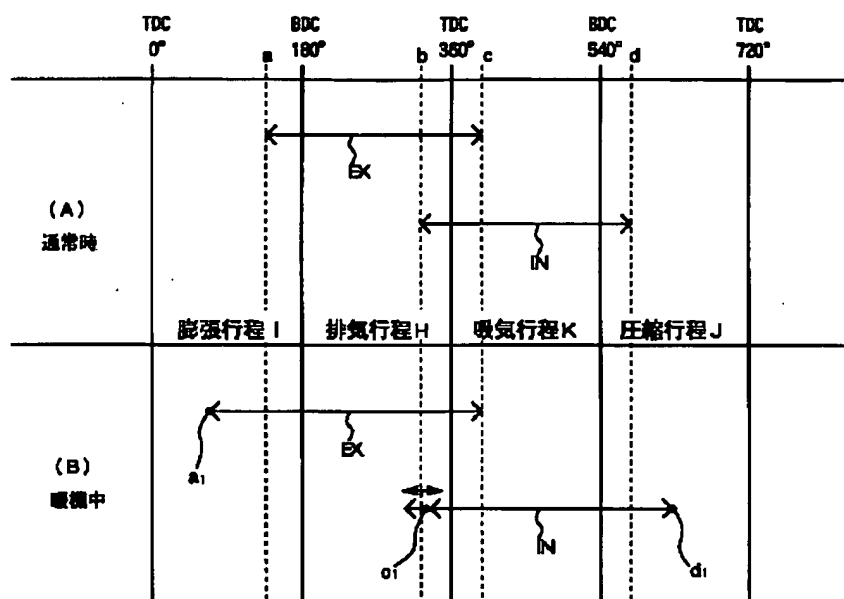
[Drawing 7]



[Drawing 8]



[Drawing 9]



[Translation done.]